

Whole Module Offgas Test Report: Space-X1 Dragon Module



On September 26 and September 28, 2012 a chemist from the JSC Toxicology Group acquired samples of air in 500 ml evacuated canisters from the sealed Space-X1 Dragon Module. One sample was also acquired from Space-X Facility near the module at the start of the test. Samples of the module air were taken in triplicate once the module had been sealed, and then taken again in triplicate 1.98 days later. Of the triplicate samples, the first served as a line purge, and the last two were analyzed. The results of 5 samples are reported in the tables. Table 1 lists the analytical concentrations. Table 2 gives the T values indexed against 7-day Spacecraft Maximum Allowable Concentrations (SMACs) and Table 2A gives T values indexed against 180-day SMACs. For purposes of the offgas test only the 7 day SMACs are relevant. The average recoveries of surrogate standards placed in the canisters to validate analytical integrity were as follows: ^{13}C -acetone, 101%; fluorobenzene, 102%; and chlorobenzene, 82%.

Analytical data contained in the Toxicology Group Report (attached) show that the ambient facility air was relatively clean (0.02 T units). The high isopropanol levels found in background samples during the previous test were not present in this test. Analyses of pairs of samples that were taken during the test show excellent agreement between the pairs and a rate of increase of 0.32 T units per day when corrected for the absence of 33% of the mass of cargo during the test. The time-zero sample showed 0.07 T units.

If the time from last purge of the module on the ground to crew first entry on orbit is 4 days as planned, then the estimated T value at the time of first entry is $0.07 + (4 \times 0.32) = 1.35$ T units. The primary contributors to the T value during the test were trimethylsilanol, acetaldehyde, and small alcohols. The Dragon heat-exchange compound, perfluoro (2-methyl) pentane, was initially detected at 0.3 mg/m^3 but accumulated to a concentration of 540 mg/m^3 during the 2-day test. This means about 5.4 g leaked from the system into the $\sim 10 \text{ M}^3$ volume of the Dragon. The vibrations of launch could cause the leak rate to substantially increase, so this non-toxic compound could be present in large concentrations at first entry.

It is important to note that this test targets compounds characteristic of offgassing from materials. Reactive compounds, such as propellants, cannot be detected by the standard offgas test method.


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